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Technical Bulletin 1990-1E

Soil climate classification and winter risk assessment for the Atlantic region based on estimated soil temperatures

Canada

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A. BOOTSMA and L.M. DWYER
Land Resource Research Centre
Ottawa, Ontario

Technical Bulletin 1990-1E
LRRC Contribution No. 89-48

Research Branch
Agriculture Canada
1990

90-04234/

Copies of this publication are available from
Director
Land Resource Research Centre
Research Branch, Agriculture Canada
Ottawa, Ontario
K1A 0C6

Produced by Research Program Service

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Cat. No. A54-8/1990-1E
ISBN 0-662-17491-7

Cover illustration
The dots on the map represent Agriculture Canada research establishments.

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SUMMARY

Soil temperatures are an important factor influencing crop growth and other physical, chemical and biological processes important to agriculture in the Atlantic region. Because soil temperature records have been kept for relatively few stations in the region, it is necessary to estimate temperatures from more readily available climatic parameters if the soil thermal regime is to be characterized on a spatial basis. This bulletin presents results of analyses of monthly mean soil temperature estimates for 53 locations in the Atlantic region obtained from an empirical regression-based soil temperature model. The model used was recently developed from data collected within the region and is an improvement over a similar model available for all of Canada. The new model was constructed particularly for estimating soil temperatures during winter months, when there is an important influence on plant survival. Statistics are presented on average monthly temperatures, derived soil climate parameters and classes, and winter low temperature extremes. This study provides a more complete and accurate characterization of soil thermal regimes for agriculture in the Atlantic region.

ACKNOWLEDGEMENTS

The assistance of the agrometeorology data processing group of the Land Resource Research Centre, Agriculture Canada under the supervision of Mr. D. Chaput in providing electronic data processing support for this project is gratefully acknowledged.

RÉSUMÉ

La température du sol a un effet important sur la croissance des cultures ainsi que sur d'autres processus physiques, chimiques et biologiques importants pour l'agriculture dans la région de l'Atlantique. Comme les données sur la température du sol ne sont recueillies que dans un nombre limité de stations de la région, il faut estimer les températures à partir de paramètres climatiques plus facilement disponibles si l'on veut caractériser le régime thermique du sol sur une base spatiale. Le présent bulletin expose les résultats d'analyses des estimations des températures mensuelles moyennes du sol pour 53 stations de la région de l'Atlantique. Ces estimations ont été obtenues à partir d'un modèle empirique fondé sur l'analyse de la régression. Ce modèle, élaboré récemment à partir de données recueillies dans la région, constitue une amélioration par rapport à un modèle semblable utilisé pour toutes les régions du Canada. Il a été mis au point tout particulièrement pour estimer les températures du sol durant l'hiver, période pendant laquelle la température du sol a un effet important sur la survie des plantes. On fournit des statistiques sur les températures mensuelles moyennes, sur les paramètres dérivés et les classes de température du sol et sur les températures minimales extrêmes de l'hiver. L'étude fournit également une description plus complète et plus exacte du régime thermique des sols agricoles dans la région de l'Atlantique.

INTRODUCTION

Soil temperature is an important factor in crop production because of its influence on many physical, chemical and biological processes such as crop growth and development, winter survival, nitrogen transformation processes in the soil, degradation of herbicides and pesticides, water movement through the soil profile and pest dynamics (Suzuki, 1972; Mack, 1973; Smid, 1976; Meikle, 1979; Lamb, 1985). In Canada, soil temperature has become an integral part of the soil classification system (Clayton et al., 1977) in recognition of its importance to agriculture. Nevertheless, there are relatively few standard climatic stations where soil temperatures are routinely monitored throughout the year. As a result, methods have been developed to estimate soil temperatures from more readily available climatic data such as air temperature and precipitation (Ouellet, 1973; Ouellet et al., 1975). Ouellet estimated average monthly soil temperatures at various depths to 150 cm using an empirical model that was developed by regression analyses of soil temperature with various monthly climatic variables. Although more physically-based models that are more general in application have been developed (e.g. Wierenga and deWit, 1970; Buchan, 1982), such models usually require knowledge of boundary conditions and soil thermal properties that is not generally available.

Ouellet's empirical model was developed using data from climatic stations located all across Canada. Although tests have shown this model to be quite reliable, biases may occur in soil temperature estimates for a specific region or location (Dwyer and Hayhoe, 1985). During winter months, Ouellet used snowfall as a predictor variable in the regressions since depth of snow on ground, which controls soil temperatures to a large extent (Hayhoe and Mukerji, 1987), was not readily available for many climate stations. In the Atlantic region, mid-winter thaws are common phenomena, and therefore snowfall is not always a reliable indicator of the depth of the insulating layer. In recent years the availability of long term records on snow depth has increased significantly so that it is now practical to use this variable in a soil temperature model. Therefore, a new empirical model to estimate average monthly soil temperatures was developed for the Atlantic region. This model has been shown to be superior to the Ouellet model for estimating soil temperatures during winter months in the region (Dwyer et al., 1988).

The purpose of this bulletin is to present results of soil temperature estimates at 10 and 50 cm depths for all available climatic stations in the Atlantic region made using the improved soil temperature model developed by Dwyer et al. (1988). In addition to average monthly soil temperatures, estimates of various soil climate parameters used in the soil climate classification system in Canada (Clayton et al., 1977) are presented for the 50 cm depth and compared to previous ratings shown on the soil climate map of Canada. Probabilities of occurrences of low monthly average soil temperatures at 10 cm during winter months are also presented because of the important infiuence of near-surface temperatures on the survival of overwintering crops such as alfalfa, winter wheat and strawberries in the region (Suzuki, 1972).

Table 1. List of monthly climatic variables used as predictors in the soil temperature models (maximum of eight variables selected).

Symbol	Description	Symbol	Description
PRST =	Estimated temperature of the previous mo. (^{o}C)	MARD =	MAXI x RDAY
MAXI =	Mean maximum air temperature (^{o}C)	MARN =	MAXI x RAIN
MINI =	Mean minimum air temperature (^{o}C)	RDRN =	RDAY x RAIN
AMAX =	Absolute maximum air temperature (^{o}C)	RDPE =	RDAY x PEVA
AMIN =	Absolute minimum air temperature (^{o}C)	PERN =	PEVA x RAIN
RDAY =	Number of rainy days	MASN =	MAXI x SNOW
RAIN =	Rainfall (mm)	RSNS =	RAIN x SNOW x SNOW
PEVA =	Potential evapotranspiration (mm)	SRDS =	SNOW x RDAY x RDAY
SNOW =	Snowfall (cm)	SOGS =	$(SOG)^2$
SOG =	Average snow depth (cm)	SG4S =	$(SGG4)^2$
SGG4 =	Number of days with snow depth > 4 cm	SG10S =	$(SGG10)^2$
SGG10 =	Number of days with snow depth > 10 cm	SG20S =	$(SGG20)^2$
SGG20 =	Number of days with snow depth > 20 cm	TSUMS =	$(TSUM)^2$
TSUM =	Sum of air temperature below 0^{o}C on days with snow depth < 4 cm	MASG =	MAXI x SOG
PSTS =	$(PRST + 35)^2$	MISG =	MINI x SOG
MAXS =	$(MAXI + 40)^2$	MISG4 =	MINI x SGG4
MINS =	$(MINI + 50)^2$	MASG4 =	MAXI x SGG4
MAMM =	(MAXI - MINI) x MAXI	MISG10 =	MINI x SGG10
		MASG10 =	MAXI x SGG10

MODEL DEVELOPMENT

Details of the development of an improved model to estimate average monthly soil temperatures for the Atlantic region have been described by Dwyer et al. (1988). Similar to the Ouellet model, it consists of multiple regression equations of the following type for each month and depth (10, 20, 50, 100 and 150 cm):

$$Y = a_0 + a_1X_1 + a_2X_2 + \ldots + a_nX_n$$

where Y is the dependent variable to be estimated (average soil temperature for a given month and depth), X_i's (i=1 to n) are the independent monthly climatic variables selected by stepwise multiple linear regression analyses from the list of variables shown in Table 1 (maximum of 8 variables) and a_i's (i=1 to n) are the partial regression coefficients. The regression equations were determined using climatic data from five locations: Charlottetown CDA, Fredericton CDA, Kentville CDA, Truro and St. John's CDA. Each regression included data up to December 1981 and involved approximately 95 cases. Only models developed for the 10 and 50 cm depth were used for the purpose of this study.

Correlation coefficients between estimated and observed soil temperatures in the regression data were typically in the range of 0.80 to 0.90 during winter months and 0.91 to 0.94 during the summer. Standard errors of estimate of the regressions were typically 0.5 to 0.8°C during winter and 0.8 to 0.9°C during summer. Independent data tests carried out on a limited amount of data indicated that estimates were generally accurate to about 1°C (Dwyer et al., 1988).

ESTIMATION OF MEAN MONTHLY SOIL TEMPERATURE

Estimates of mean monthly soil temperatures at 10 and 50 cm depths were made using the improved model developed by Dwyer et al. (1988) for all climatic stations shown in Table 2 and in Figure 1. Estimates were made for all years and months for which monthly variables required as input into the model were available, which was frequently less than the period shown in Table 2. Following is a brief summary of the estimation procedures.

Monthly climatic variables required as estimators for the model were computed from daily climatological data available from a computer archive maintained by Agriculture Canada, Land Resource Research Centre (LRRC). These data were originally supplied by Environment Canada (AES) but have been reformatted into daily records for convenience in data processing. Missing records have been estimated for all observed variables (maximum and minimum air temperature, rainfall, snowfall and total precipitation), except depth of snow on ground, using established procedures (D. Chaput, LRRC, personal communication). The monthly variables computed from daily records were used as input into the soil temperature model to estimate mean monthly soil temperatures at each location for all years with available data. Months requiring snow depth as a predictor variable were only used if there were no

Table 2. Stations and record periods used in soil temperature study.

Map ID*	Station name	Record period
NEW BRUNSWICK		
3	Aroostook	1961-80
1	Charlo A	1968-86
2	Chatham A	1956-86
5	Fredericton A	1956-86
4	Fredericton CDA	1960-86
6	Gagetown 2	1964-80
8	Moncton A	1956-86
7	Saint John A	1956-86
NOVA SCOTIA		
17	Baccaro	1960-79
25	Baddeck	1963-86
28	Cheticamp	1962-77
22	Collegeville	1974-82
13	Digby Prim Point	1966-81
23	Eddy Point	1973-85
12	Greenwood A	1956-86
19	Halifax Int'l A	1961-86
27	Ingonish Beach	1962-80
11	Kentville CDA	1961-86
29	Margaree Forks	1962-80
15	Meteghan River	1972-80
9	Nappan CDA	1960-83
10	Parrsboro	1960-79
30	Port Hood	1962-80
24	River Denys	1972-80
18	Shearwater A	1956-86
26	Sydney A	1956-86
21	Trafalgar	1963-80
20	Truro	1961-86
14	Weymouth Falls	1966-80
16	Yarmouth A	1956-86
PRINCE EDWARD ISLAND		
41	Alberton	1972-80
34	Alliston CDA EPF	1962-77
33	Bangor	1973-81
36	Charlottetown A	1956-86
35	Charlottetown CDA	1960-86
31	East Baltic	1973-80
37	Hunter River	1973-80
32	Monticello Armadale	1963-81
38	New London	1971-80
40	O'Leary	1962-80
39	Summerside A	1956-86
42	Tignish	1973-84
NEWFOUNDLAND		
51	Colinet	1962-86
47	Comfort Cove	1968-86
45	Deer Lake	1966-86
48	Gander Int'l A	1956-86
43	Port Aux Basques	1961-86
49	St. John's A	1956-86
50	St. John's West CDA	1961-83
46	Springdale GB Farm	1961-86
53	St. Albans	1970-83
44	Stephenville A	1955-86
52	St. Lawrence	1967-86

* Corresponds to station numbers in Fig. 1.

missing observations of this variable, or if missing data could be reliably estimated. For each year, estimates were begun in October of the previous year. This procedure was necessary to obtain an estimate of December's soil temperature which is required as an estimator variable in the model for January. Only available estimates from January to December were retained for further analyses. Since the model uses the previous month's soil temperature estimate as one of the predictor variables for most months, estimates could not be made for any month following the first month with this variable missing in a given year.

REPRESENTATIVENESS OF THE ESTIMATES

The model used in this study was developed from soil temperature data collected at sites with predominantly sandy loam soils that are moderately well-drained and covered by a short grass surface. During winter months the soil is protected by natural snow cover typical for the area. Thus the estimates are most representative of these conditions. Variation from these conditions could result in significant changes in soil temperature. For example, poorly drained soils and organic soils warm and cool more slowly than well drained soils. Drifting snow during winter can either increase or decrease the snow cover and modify the insulating effect. Soil temperatures will also be modified by different microclimates which exist under forests and crops.

The estimates are assumed to represent the area in which the climate station is located. Soil temperature estimates could be biased, however, if the climate station is situated in a more sheltered or more exposed situation than is typical of the area. Record period can also influence the results as will be seen later in this study. Because of the empirical nature of the model, estimates may not be reliable for stations located outside of the area in which the model was developed. For example, when the model was used on data from two stations in Labrador (Cartwright and Goose A), estimated soil temperatures for November were found to be unstable and exceptionally low in some years and consequently these stations were not included in this study. One station in northern New Brunswick (Little River Mine) was excluded for the same reason.

ANALYSES OF SOIL TEMPERATURE ESTIMATES

The estimates of mean monthly soil temperatures for individual months were used to compute a variety of statistics and derived parameters (Appendix 1). Following is a brief explanation of each of the variables contained in the appendix.

Average Soil Temperature (T_{ave})

Average Soil Temperature (T_{ave}) is computed by averaging all available estimates of mean soil temperatures for a given month for the 10 and 50 cm depths, respectively. The number of years (cases) used to compute the

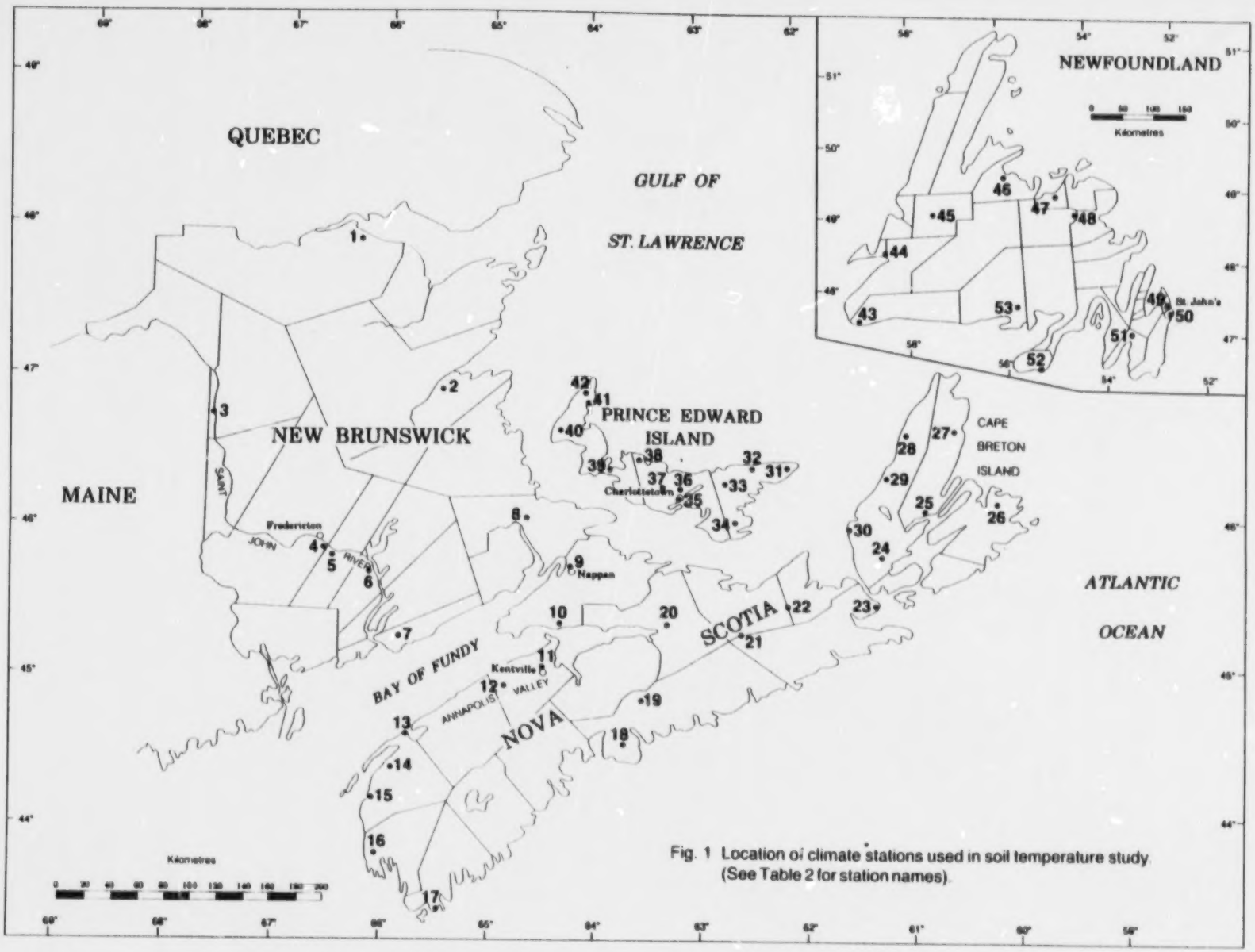

Fig. 1 Location of climate stations used in soil temperature study (See Table 2 for station names).

average is shown in brackets below each monthly value. The number of cases may decline for later months in the year due to missing climatic data.

Soil Climatic Parameters (50 cm depth)

Soil climatic parameters used for classifying soil temperature regimes in Canada (Clayton, et al., 1977) were determined from the average mean monthly soil temperatures at 50 cm depth. Daily average soil temperatures were interpolated from monthly averages using the Brooks (1943) sine-wave interpolation procedure. Soil climatic parameters were then computed from the daily estimates as follows:

Mean annual soil temperature (MAST): The average of 365 daily values for the year (^{o}C).

Mean summer soil temperature (MSST): The average of daily estimates from June 1 to August 31 (^{o}C).

Degree-days > 5^{o}C (DD > 5^{o}C): Accumulated daily average temperatures above a base value of 5^{o}C.

Days > 5^{o}C: The number of days in the year when average soil temperatures are above 5^{o}C.

Degree-days > 15^{o}C (DD > 15^{o}C): Accumulated daily average temperatures above a base value of 15^{o}C.

Days > 15^{o}C: The number of days in the year when average soil temperatures are above 15^{o}C.

Class: The soil temperature class used in the soil climate classification system for Canada (Clayton et al., 1977). MAST and MSST are primary classifiers, degree-days and days > 5^{o}C are secondary classifiers, and degree-days and days >15^{o}C are used only as supplementary information in the classification system. Generalized limits of these parameters for classes which apply to the Atlantic region are summarized in Table 3. In some cases where the class division is unclear, a station may be indicated as ranging over two classes. In other instances, a single class was assigned even though one parameter was outside the class range. For example, several stations were placed in the moderately cool Boreal class (4.2) although they had MSST values below 15^{o}C, the low boundary of this class, because the DD > 5^{o}C were well above the lower limit of 1388.

Lowest Monthly Average Temperature (10 cm depth)

Because of the important influence of soil temperatures near the surface during winter months on winter survival of plants, various statistics on the lowest mean monthly soil temperatures at the 10 cm depth were computed. Initially, the lowest average monthly soil temperature for the 6-month period

Table 3. Generalized characteristics of selected temperature classes used by the soil climate classification system for Canada.*

Class	Parameters					
	MAST	MSST	DD >5°C	DAYS >5°C	DD >15°C	DAYS >15°C
3. CRYOBOREAL	2-8°C	8-15°C	555-1250	120-220	< 33	
3.1 Cold			555-1110	120-180		
3.2 Moderately Cold			1110-1250	<220		
4. BOREAL	5-8°C	15-18°C	1250-1720	170-220	33-222	<120
4.1 Cool			1250-1388	>170		<60
4.2 Moderately Cool			1388-1720	<220		<120
5. MESIC	8-15°C	15-22°C	1720-2775	200-365	167-666	<180
5.1 Mild			1720-2220	200-240		<120

* Based on Clayton et al., 1977.

from November to April was selected from each year's data. A year was treated as missing if estimates were not available for any one of the months between January-March. Missing data during all other months were tolerated since the lowest monthly average temperature occurred during the January-March period. The series of yearly minimum average monthly soil temperatures for each station were used to determine statistics shown in Appendix 1 as follows:

Average lowest temperature ($\bar{T}_{MIN}$): The average of the lowest average monthly soil temperature for each year.

Extreme lowest temperature (T_{LOW}): The lowest average monthly soil temperature estimated for the station.

Lowest 1 year in 10 (10% risk) ($T_{10\%}$): The lowest average monthly soil temperatures are equal or lower than the given value 1 year in 10.

Lowest 1 year in 5 (20% risk) ($T_{20\%}$): The lowest average monthly soil temperatures are equal or lower than the given value 1 year in 5.

Probability of temperature < $0^{\circ}C$ (P_0): The probability that the lowest average monthly soil temperature for the year is equal to or less than $0^{\circ}C$. Probabilities are also shown for threshold temperatures of -1, -2 and $-5^{\circ}C$ if applicable (P_{-1}, P_{-2} and P_{-5}).

Years of data: The number of years of data used in computing statistics on the lowest monthly average soil temperature at 10 cm depth.

To compute probability levels, yearly values for lowest monthly average soil temperatures were ranked in ascending order from the lowest to the highest. The probability (P) of soil temperatures equal or lower than each ranked value is then determined as follows (Environment Canada, 1982):

$$P\ (\%) = 100 \times \frac{k}{N + 1}$$

where N is the total number of values being ranked (years) and k is the rank of each value, ranging from 1 to N.

Probability levels for temperatures that fall between ranked values were determined by linear interpolation, as were temperature values for selected probability levels. No smoothing was applied to the ranked temperature values.

EFFECT OF RECORD PERIOD

A number of stations used in the analyses had record periods of considerably shorter duration than 31 years, the longest available period (see Appendix 1). Some stations had record lengths of only 8 years for extreme winter minimum temperatures and even less than that for average soil temperatures for some months. The effect that a varying record period has on the results is therefore of some concern, particularly for probability analyses. Five stations with 31 years data were selected and analyses were carried out for varying record periods at these stations. Primary and secondary soil climate classifiers and the soil climate class were not significantly influenced by record period to as short as 8 years (Table 4). Thus, results for all locations used in this study should be quite reliable with respect to these variables, and no adjustment for record period was needed. The average lowest monthly soil temperature during winter (T_{MIN}) was also relatively insensitive to record period. However, extreme temperatures 1 year in 10 ($T_{10\%}$) and probability of $-2^{\circ}C$ (P_{-2}) were quite seriously affected at Fredericton, Greenwood and Charlottetown. Data for these variables from short term stations should be interpreted cautiously and, if possible, adjusted for record period.

Table 4. Effect of record period on selected soil temperature variables.

Location	Record period	Duration (yrs)	MAST (°C)	HSST (°C)	DD>5°C	DAYS >5°C	$\bar{T}_{MIN}$	$T_{10\Sigma}$ (°C)	P_{-2} (%)	Soil Climate Class
Fredericton A, N.B.	1971-80	10	8.5	17.3	1812	205	-1.4	-3.2	39	5.1 mild Mesic
	1966-80	15	8.5	17.2	1805	206	-1.4	-4.0	33	5.1 mild Mesic
	1961-80	20	8.4	17.1	1788	206	-1.4	-3.3	31	5.1 mild Mesic
	1956-86	31	8.4	17.1	1793	207	-1.2	-2.9	23	5.1 mild Mesic
Greenwood A, N.S.	1971-80	10	8.9	17.1	1837	220	-0.5	-3.0	15	5.1 mild Mesic
	1961-80	20	8.8	17.0	1825	220	-0.3	-1.2	8	5.1 mild Mesic
	1956-86	31	9.0	17.0	1845	224	0.0	-0.7	5	5.1 mild Mesic
Yarmouth A, N.S.	1971-80	10	8.0	13.9	1456	230	0.5	-0.2	-	4.1-4.2 cool to moderately cool Boreal
	1966-80	15	8.1	13.8	1460	230	0.5	-0.4	-	4.1-4.2 cool to moderately cool Boreal
	1961-80	20	7.9	13.6	1428	228	0.5	-0.2	-	4.1-4.2 cool to moderately cool Boreal
	1956-86	31	8.0	13.7	1449	231	0.6	-0.1	-	4.1-4.2 cool to moderately cool Boreal
Charlottetown A, P.E.I.	1973-80	8	7.3	14.6	1420	201	-1.9	-4.4	37	4.2 moderately cool Boreal
	1971-80	10	7.3	14.6	1419	201	-1.7	-4.8	39	4.2 moderately cool Boreal
	1961-80	20	7.9	14.7	1451	205	-1.1	-4.4	27	4.2 moderately cool Boreal
	1956-86	31	7.6	14.5	1439	208	-0.5	-3.1	16	4.2 moderately cool Boreal
St. John's A, Nfld.	1971-86	10	6.6	12.1	1102	197	0.0	-0.7	-	3.1-3.2 cold to moderately cold Cryoboreal
	1961-80	20	6.8	12.1	1112	201	0.2	-0.7	-	3.2 moderately cold Cryoboreal
	1956-86	31	6.8	12.1	1118	202	0.2	-0.7	-	3.2 moderately cold Cryoboreal

SPATIAL DISTRIBUTION OF SELECTED VARIABLES

Although geographic variation in the various parameters computed in this study can be determined by examining individual station summaries in Appendix 1, several variables were selected for mapping to define regions or zones with similar soil climates.

Soil Temperature Classes

Soil temperature classes based on the soil climate classification system in use in Canada (Clayton et al., 1977) are shown for each location in Figure 2. Although station density was inadequate in many areas for drawing accurate zone boundaries, lines were drawn to identify regions of similar climatic zones. Differences in topography, soil drainage, texture, vegetation and management were not taken into account when drawing these zones. In spite of these limitations, it is interesting to note several distint differences between these results and the Soil Climates of Canada map as follows:

- The mild Mesic class (5.1) in the Fredericton, N.B. vicinity did not appear on the soil climate map of Canada.
- Prince Edward Island, previously mapped as cool Boreal (4.1), has classes ranging from Boreal (4.2) in the southern part to moderately cool Cryoboreal (3.2) in eastern Kings county.
- Most of southern Nova Scotia is cool Boreal (4.1) whereas this was previously moderately cool Boreal (4.2) to mild Mesic (5.1). The extreme southern tip near Baccaro is rated as moderately cold Cryoboreal (3.2) although it is close to a cool Boreal (4.1) rating.
- Eastern Cape Breton Island has a substantial area rated as moderately cool Boreal (4.2) which was previously mapped as moderately cool Cryoboreal (3.2).
- The largely non-agricultural land area in north-central New Brunswick previously rated as moderately cold Cryoboreal (3.2) could not be rated in this study due to lack of stations with snow depth records.
- Although areas near Moncton, N.B. and Nappan, N.S. are rated as moderately cool Boreal (4.2) in this study, some of the soil climate variables suggest that the rating of cool Boreal (4.1) on the Soils of Canada map is also quite realistic for this area. Station data were not available for most of the agricultural land along the north shore of Nova Scotia to obtain reliable class estimates for that region, although surrounding stations suggest a class of 4.2 or 4.1.
- The moderately cold Cryoboreal class appears to extend to much of western Newfoundland, while the cold Cryoboreal zone (3.1) is extended to include the southern tip of the Avalon and Burin peninsulas. These ratings apply only to the mineral soils in the region and are not valid for organic soils.

Minimum Temperature During Winter Months

Due to the important influence of soil temperature during winter months on survival of crops, the lowest average monthly soil temperature for the year at the 10% probability level ($T_{10\%}$) was selected for spatial presentation (Figure 3). However, because of the significant effect of record period

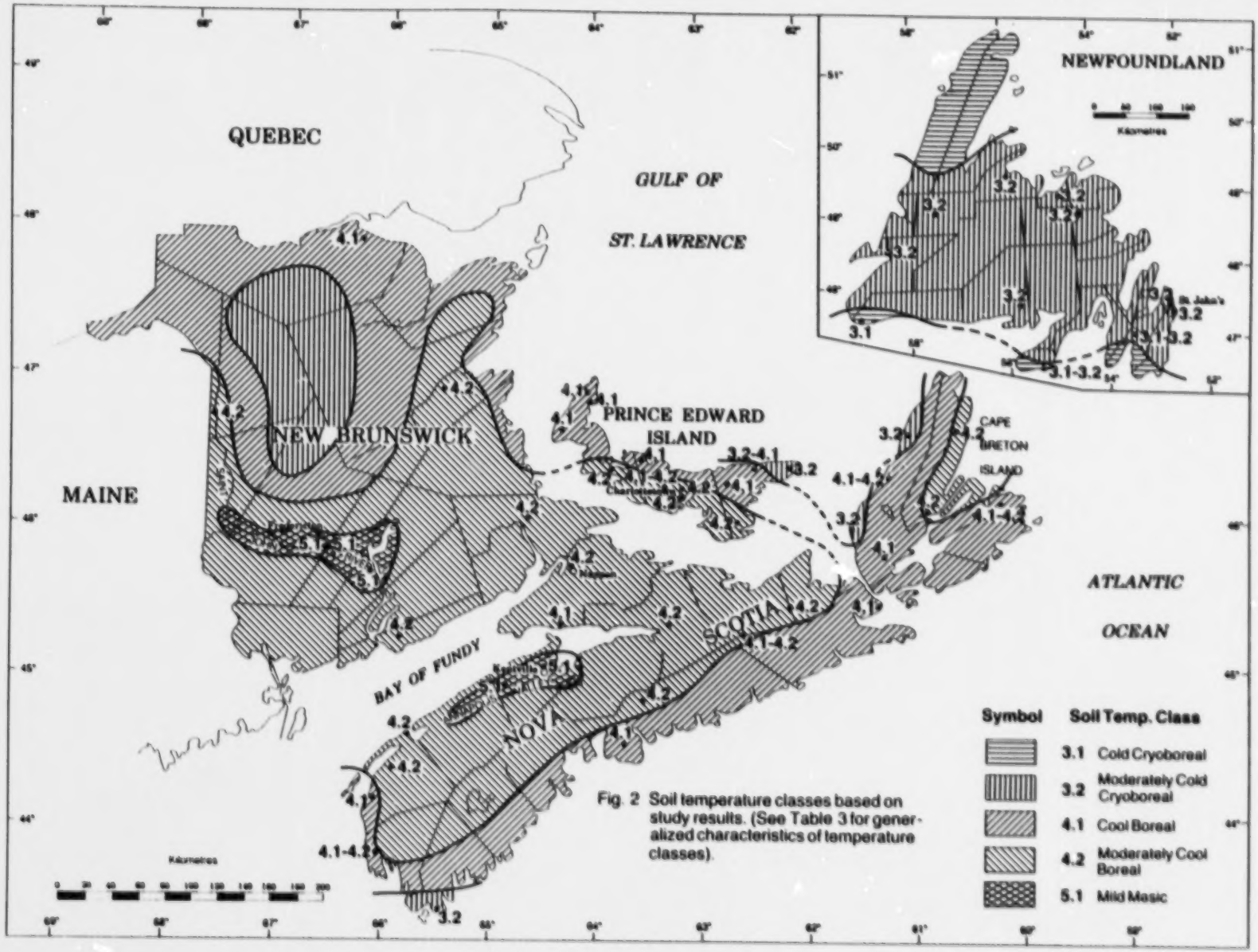

Fig. 2 Soil temperature classes based on study results. (See Table 3 for generalized characteristics of temperature classes).

(Table 4), values for short term stations located in the vicinity of long term stations shown in Table 4 were adjusted to the 31-year period. The adjustment was based on the difference between the 31-year period and the record period in Table 4 which corresponded most closely to the period of the short term station. Values of $T_{10\%}$ plotted in Figure 3 are one of three types: (i) non-adjusted data; (ii) non-adjusted data with possible bias due to short record period (indicated by an asterisk *); (ii) short-term data adjusted to 31-year period (indicated by brackets ()). Zones were drawn to illustrate areas with similar values for $T_{10\%}$. Again, due to the relatively low density of stations it was difficult to draw accurate zone boundaries.

Lowest temperatures ($\leq -4^{\circ}C$) were estimated in the northwest tip of Prince Edward Island, with temperatures moderating towards the southeastern region. Much of north-central New Brunswick has values between -3 and $-4^{\circ}C$, although data were lacking from the predominantly non-agricultural area. The value of $-3.3^{\circ}C$ at Saint John A, New Brunswick seems exceptionally low, but may reflect the low amount of snow cover frequently experienced in the area. In Nova Scotia, temperatures are lowest in the Nappan region and western Cape Breton Island and moderate gradually to the warmest region around the southwestern area near Yarmouth. Data are lacking for much of the agricultural land along the north shore of Nova Scotia, and this area possibly could be one zone colder than shown in Fig. 3.

Newfoundland had lowest values for $T_{10\%}$ in the northeastern region, with gradual warming to the south and west coast. Station density is generally inadequate in Newfoundland for positioning zone boundaries accurately.

It is presently not known if there is a direct relationship between $T_{10\%}$ and the frequency of winterkill in the region. In some cases, general patterns appear realistic. For example, winterkill is less of a problem in the Annapolis Valley than in much of New Brunswick and Prince Edward Island. However, poor ratings in northern New Brunswick, and the substantial differences between west and east Prince Edward Island, are not clearly reflected in field observations of survival that have been made in the region (M. Suzuki, personal communications). It should be noted, however, that the maps display only climatic differences and do not account for effects of factors such as soil physical characteristics and management on survival.

The frequency of occurrence of average monthly soil temperatures of $-2^{\circ}C$ or lower in 10 years (F_{-2}) at the 10 cm depth is mapped in Figure 4, where $F_{-2} = P_{-2}/10$. In some instances, values were adjusted to account for record period in the same manner as for $T_{10\%}$. Values range from 2.5 years or more in 10 for northwestern Prince Edward Island, to less than 1 year in 20 for the south shore of Nova Scotia, the Annapolis Valley and southern Newfoundland. Zone boundaries in Prince Edward Island run more east to west compared to $T_{10\%}$ and thus may reflect risk of winter injury more closely.

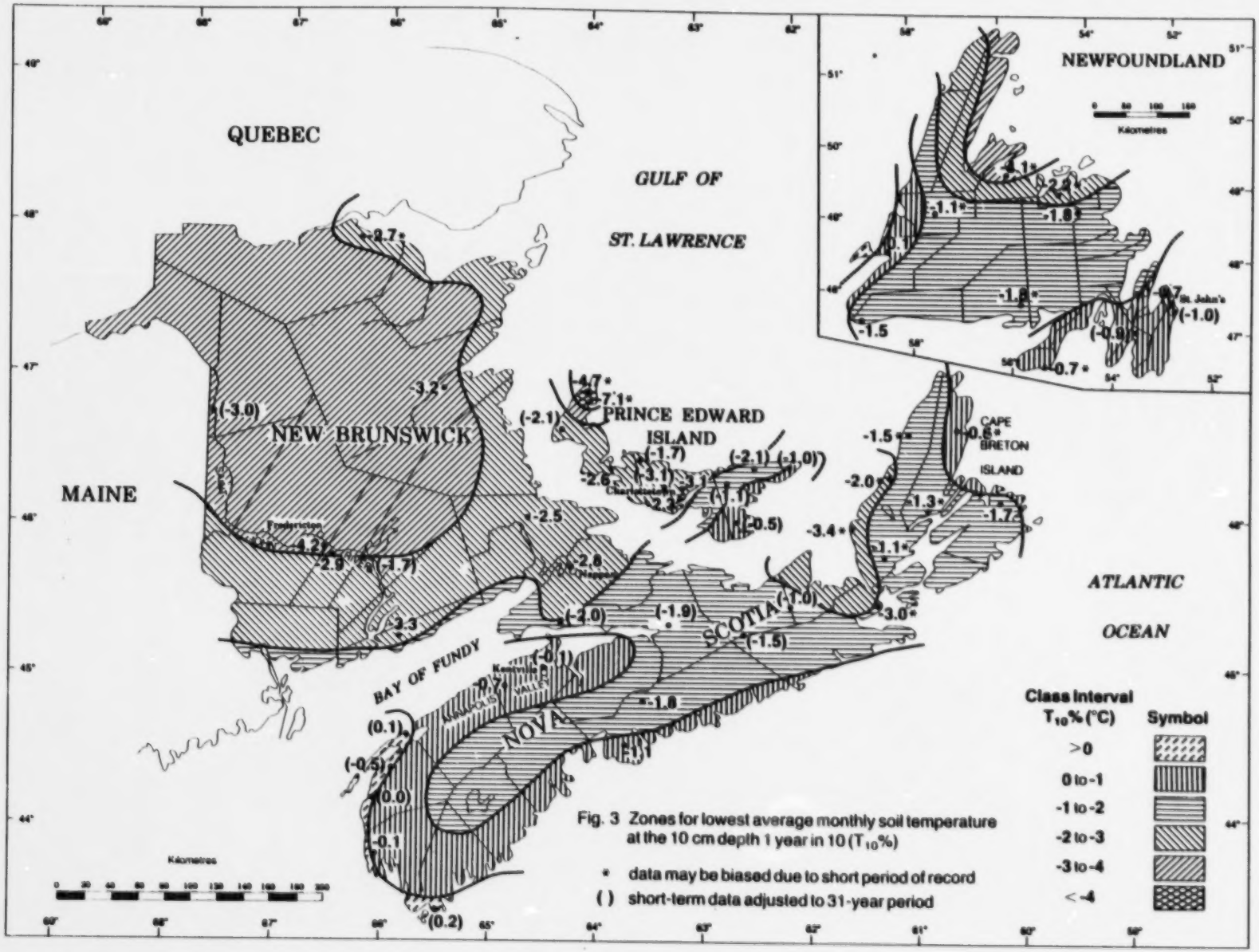

Fig. 3 Zones for lowest average monthly soil temperature at the 10 cm depth 1 year in 10 (T_{10}%)

* data may be biased due to short period of record

( ) short-term data adjusted to 31-year period

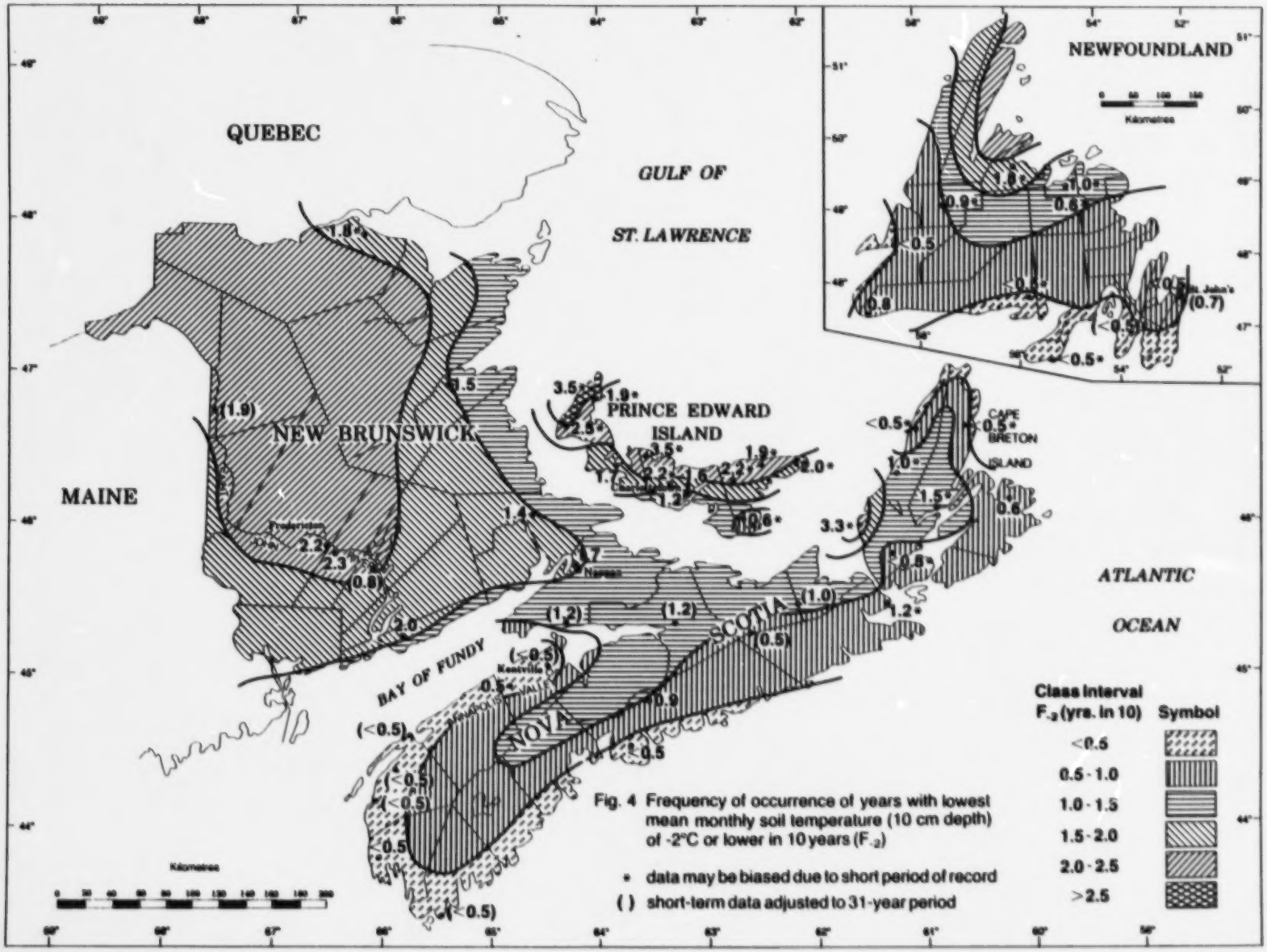

Fig. 4 Frequency of occurrence of years with lowest mean monthly soil temperature (10 cm depth) of -2°C or lower in 10 years (F_{-2})

* data may be biased due to short period of record

( ) short-term data adjusted to 31-year period

Further comparisons with field observations may help to determine if there is a good relationship between $T_{10\%}$ or F_{-2} and winter survival. However, it is recognized that other climatic factors not directly incorporated in these variables such as freeze/thaw cycles, mild temperatures causing loss of plant hardiness and smothering due to flooding may contribute to winterkill in some years. Thus it may be necessary to include other climatic factors to establish a good index for predictability of winter survival.

CONCLUSION

This study has provided a more detailed analysis of the soil thermal regime in the Atlantic region than has been previously available. The estimates have indicated some significant changes in soil climate classes based on the Canada soil climate classification system.

This is the first time, to our knowledge, that estimates of monthly soil temperatures have been made for each year of the record period for a large number of stations. These estimates have facilitated frequency analyses of winter minimum temperature extremes which could not be made by using estimates of normal monthly temperatures (Ouellet et al., 1975). However, because the model required snow depth, which is not available at all climate stations, fewer stations could be analyzed than was previously done by Ouellet using climatic normals data from the 1941-1970 period.

The availability of soil temperature estimates on a monthly basis contributes to a more detailed understanding of the variability among years and locations. Knowledge of this variability is particularly important during winter months when soil temperature affects winter survival. The zonation presented here will help to identify areas which have the best chance of winter survival and pinpoint areas which require more detailed field assessment.

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NEW BRUNSWICK

AROOSTOOK 8100300 Period : 1961-1980

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	-0.5	-1.3	-0.4	1.6	9.6	16.3	19.2	18.7	14.5	9.6	2.3	0.1
	(20)	(17)	(17)	(17)	(17)	(17)	(17)	(17)	(17)	(17)	(17)	(17)
50cm	1.1	0.2	0.4	1.3	7.3	13.5	16.7	17.3	14.8	10.8	4.2	1.8
	(20)	(17)	(17)	(17)	(17)	(17)	(17)	(17)	(17)	(17)	(17)	(17)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.5 C
DEGREE-DAYS > 5 C = 1551.
DEGREE-DAYS > 15 C = 132.
CLASS = Moderately Cool BOREAL

MSST = 15.9 C
DAYS > 5 C = 190.
DAYS > 15 C = 81.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -1.6 C
Extreme Lowest Temp. = -6.5 C
Lowest 1 year in 10 (10% Risk) = -3.70 C
Lowest 1 year in 5 (20% Risk) = -2.40 C
Probability of Temp =< -1.00 C = 61.1%
Probability of Temp =< -2.00 C = 27.8%
Probability of Temp =< -5.00 C = 7.9%
Years of Data = 17

CHARLO A 8100880 Period : 1968-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	-0.2	-0.2	0.2	1.2	7.7	14.2	17.9	17.7	13.4	9.1	1.8	0.0
	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(19)
50cm	1.5	1.1	0.9	1.1	6.0	11.9	15.8	16.3	13.8	10.6	3.7	1.7
	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(19)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.1 C
DEGREE-DAYS > 5 C = 1367.
DEGREE-DAYS > 15 C = 64.
CLASS = Cool BOREAL

MSST = 14.7 C
DAYS > 5 C = 181.
DAYS > 15 C = 58.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.7 C
Extreme Lowest Temp. = -2.8 C
Lowest 1 year in 10 (10% Risk) = -2.70 C
Lowest 1 year in 5 (20% Risk) = -1.80 C
Probability of Temp =< 0.00 C = 75.0%
Probability of Temp =< -1.00 C = 23.6%
Probability of Temp =< -2.00 C = 18.0%
Years of Data = 19

NEW BRUNSWICK

CHATHAM A 8101000 Period : 1956-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	-0.9	-0.9	-0.1	1.9	9.3	15.8	19.6	19.4	15.0	9.6	3.7	0.5
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)
50cm	1.0	0.4	0.4	1.3	7.1	13.2	17.2	17.9	15.2	11.1	5.7	2.4
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.8 C
DEGREE-DAYS > 5 C = 1618.
DEGREE-DAYS > 15 C = 176.
CLASS = Moderately Cool BOREAL

MSST = 16.2 C
DAYS > 5 C = 198.
DAYS > 15 C = 84.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -1.2 C
Extreme Lowest Temp. = -6.1 C
Lowest 1 year in 10 (10% Risk) = -3.20 C
Lowest 1 year in 5 (20% Risk) = -1.80 C
Probability of Temp =< 0.00 C = 90.6%
Probability of Temp =< -1.00 C = 40.6%
Probability of Temp =< -2.00 C = 15.3%
Probability of Temp =< -5.00 C = 6.0%
Years of Data = 31

FREDERICTON A 8101500 Period : 1956-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	-0.6	-0.9	-0.1	3.2	11.2	17.0	20.4	19.8	15.4	9.8	4.0	0.7
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)
50cm	1.2	0.4	0.6	2.4	9.1	14.6	18.1	18.5	15.7	11.3	6.2	2.7
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)

Soil Climatic Parameters (50 cm Depth)

MAST = 8.4 C
DEGREE-DAYS > 5 C = 1793.
DEGREE-DAYS > 15 C = 241.
CLASS = Mild MESIC

MSST = 17.1 C
DAYS > 5 C = 207.
DAYS > 15 C = 95.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -1.2 C
Extreme Lowest Temp. = -5.1 C
Lowest 1 year in 10 (10% Risk) = -2.86 C
Lowest 1 year in 5 (20% Risk) = -2.40 C
Probability of Temp =< 0.00 C = 90.6%
Probability of Temp =< -1.00 C = 46.9%
Probability of Temp =< -2.00 C = 23.4%
Probability of Temp =< -5.00 C = 3.3%
Years of Data = 31

NEW BRUNSWICK

FREDERICTON CDA 8101600 Period : 1960-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	-0.9	-1.1	-0.1	2.8	11.1	16.9	20.0	19.4	15.4	10.0	4.2	0.5
	(21)	(21)	(21)	(19)	(19)	(19)	(19)	(19)	(19)	(18)	(17)	(17)
50cm	1.1	0.4	0.5	1.9	8.7	14.3	17.6	18.0	15.5	11.2	6.1	2.5
	(21)	(21)	(21)	(19)	(19)	(19)	(19)	(19)	(19)	(18)	(17)	(17)

Soil Climatic Parameters (50 cm Depth)

MAST = 8.2 C
DEGREE-DAYS > 5 C = 1729.
DEGREE-DAYS > 15 C = 202.
CLASS = Mild MESIC

MSST = 16.7 C
DAYS > 5 C = 206.
DAYS > 15 C = 93.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -1.4 C
Extreme Lowest Temp. = -5.2 C
Lowest 1 year in 10 (10% Risk) = -4.22 C
Lowest 1 year in 5 (20% Risk) = -2.26 C
Probability of Temp =< -1.00 C = 45.5%
Probability of Temp =< -2.00 C = 22.0%
Probability of Temp =< -5.00 C = 6.1%
Years of Data = 21

GAGETOWN 2 8101800 Period : 1964-1980

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	-0.1	-0.2	0.4	3.7	10.8	16.5	20.1	19.7	15.6	10.6	4.9	1.2
	(16)	(16)	(16)	(15)	(15)	(15)	(15)	(15)	(15)	(15)	(14)	(14)
50cm	1.6	1.0	0.9	3.0	8.8	14.1	17.7	18.3	15.7	11.6	6.6	3.1
	(16)	(16)	(16)	(15)	(15)	(15)	(15)	(15)	(15)	(15)	(14)	(14)

Soil Climatic Parameters (50 cm Depth)

MAST = 8.6 C
DEGREE-DAYS > 5 C = 1768.
DEGREE-DAYS > 15 C = 216.
CLASS = Mild MESIC

MSST = 16.7 C
DAYS > 5 C = 211.
DAYS > 15 C = 93.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.6 C
Extreme Lowest Temp. = -4.4 C
Lowest 1 year in 10 (10% Risk) = -2.93 C
Lowest 1 year in 5 (20% Risk) = -1.68 C
Probability of Temp =< 0.00 C = 58.8%
Probability of Temp =< -1.00 C = 27.5%
Probability of Temp =< -2.00 C = 17.6%
Years of Data = 16

NEW BRUNSWICK

MONCTON A 8103200 Period : 1956-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	-0.4	-0.7	0.0	2.2	9.5	15.5	18.9	18.7	14.9	9.8	4.5	0.9
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)
50cm	1.4	0.7	0.6	1.8	7.5	12.9	16.6	17.2	14.9	10.9	6.6	2.9
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.9 C
DEGREE-DAYS > 5 C = 1582.
DEGREE-DAYS > 15 C = 128.
CLASS = Moderately Cool BOREAL

MSST = 15.6 C
DAYS > 5 C = 208.
DAYS > 15 C = 78.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.9 C
Extreme Lowest Temp. = -5.4 C
Lowest 1 year in 10 (10% Risk) = -2.54 C
Lowest 1 year in 5 (20% Risk) = -1.62 C
Probability of Temp =< 0.00 C = 73.4%
Probability of Temp =< -1.00 C = 37.5%
Probability of Temp =< -2.00 C = 14.4%
Probability of Temp =< -5.00 C = 4.0%
Years of Data = 31

SAINT JOHN A 8104900 Period : 1956-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	-0.5	-1.0	-0.1	2.5	9.2	14.4	17.3	17.5	14.6	9.8	4.8	1.0
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)
50cm	1.3	0.5	0.6	2.0	7.1	11.8	15.3	15.9	14.3	10.6	6.6	2.9
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.5 C
DEGREE-DAYS > 5 C = 1426.
DEGREE-DAYS > 15 C = 43.
CLASS = Moderately Cool BOREAL

MSST = 14.4 C
DAYS > 5 C = 209.
DAYS > 15 C = 59.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -1.1 C
Extreme Lowest Temp. = -4.2 C
Lowest 1 year in 10 (10% Risk) = -3.30 C
Lowest 1 year in 5 (20% Risk) = -2.02 C
Probability of Temp =< 0.00 C = 87.5%
Probability of Temp =< -1.00 C = 40.6%
Probability of Temp =< -2.00 C = 20.3%
Years of Data = 31

NOVA SCOTIA

BACCARO 8200250 Period : 1960-1979

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	1.5	1.1	1.2	4.8	8.6	12.0	14.5	14.6	13.9	11.3	7.0	3.8
	(20)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(17)	(17)	(17)
50cm	2.5	1.6	1.7	3.5	7.1	9.4	12.1	12.6	12.5	11.6	7.6	4.8
	(20)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(17)	(17)	(17)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.3 C
DEGREE-DAYS > 5 C = 1167.
DEGREE-DAYS > 15 C = 0.
CLASS = Moderately Cold CRYOBOREAL

MSST = 11.4 C
DAYS > 5 C = 227.
DAYS > 15 C = 0.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = 0.8 C
Extreme Lowest Temp. = -0.6 C
Lowest 1 year in 10 (10% Risk) = 0.12 C
Lowest 1 year in 5 (20% Risk) = 0.48 C
Probability of Temp =< 0.00 C = 9.2%
Years of Data = 18

BADDECK 8200300 Period : 1963-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.7	0.0	0.3	2.5	8.3	13.9	17.5	18.1	15.2	10.7	6.1	2.5
	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(17)	(17)	(17)
50cm	2.0	1.1	0.9	2.0	6.5	11.3	14.9	16.4	15.0	11.2	7.2	3.9
	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(17)	(17)	(17)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.8 C
DEGREE-DAYS > 5 C = 1462.
DEGREE-DAYS > 15 C = 63.
CLASS = Moderately Cool BOREAL

MSST = 14.3 C
DAYS > 5 C = 212.
DAYS > 15 C = 63.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.1 C
Extreme Lowest Temp. = -1.7 C
Lowest 1 year in 10 (10% Risk) = -1.30 C
Lowest 1 year in 5 (20% Risk) = -0.90 C
Probability of Temp =< 0.00 C = 50.0%
Probability of Temp =< -1.00 C = 15.0%
Years of Data = 19

NOVA SCOTIA

CHETICAMP 8200825 Period : 1962-1977

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.9	0.0	0.1	1.7	6.7	13.1	16.8	17.4	14.5	10.4	6.2	2.9
	(12)	(11)	(9)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)
50cm	2.2	1.3	0.7	1.5	5.0	10.5	14.0	15.6	14.1	11.4	7.5	4.4
	(12)	(11)	(9)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.4 C
DEGREE-DAYS > 5 C = 1338.
DEGREE-DAYS > 15 C = 18.
CLASS = Moderately Cold CRYOBOREAL

MSST = 13.4 C
DAYS > 5 C = 207.
DAYS > 15 C = 36.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.2 C
Extreme Lowest Temp. = -1.5 C
Lowest 1 year in 10 (10% Risk) = -1.50 C
Lowest 1 year in 5 (20% Risk) = -0.80 C
Probability of Temp =< 0.00 C = 50.0%
Probability of Temp =< -1.00 C = 17.1%
Years of Data = 9

COLLEGEVILLE 8201000 Period : 1974-1982

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	-0.3	-0.9	0.0	2.4	8.8	14.5	17.9	18.2	15.3	10.0	5.3	1.6
	(12)	(11)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(8)	(8)
50cm	1.3	0.6	0.7	2.1	7.1	12.1	15.5	16.6	15.1	11.0	6.6	3.2
	(12)	(11)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(8)	(8)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.7 C
DEGREE-DAYS > 5 C = 1503.
DEGREE-DAYS > 15 C = 82.
CLASS = Moderately Cool BOREAL

MSST = 14.8 C
DAYS > 5 C = 208.
DAYS > 15 C = 71.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -1.0 C
Extreme Lowest Temp. = -2.8 C
Lowest 1 year in 10 (10% Risk) = -2.80 C
Lowest 1 year in 5 (20% Risk) = -2.80 C
Probability of Temp =< 0.00 C = 73.3%
Probability of Temp =< -1.00 C = 42.5%
Probability of Temp =< -2.00 C = 26.1%
Years of Data = 9

NOVA SCOTIA

DIGBY PRIM POINT 8201605 Period : 1966-1981

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	1.0	0.6	1.0	4.9	9.7	14.4	17.2	17.2	15.1	11.2	6.6	3.1
	(15)	(15)	(15)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(13)	(12)
50cm	2.2	1.4	1.3	3.7	8.2	11.8	15.0	15.6	14.5	12.2	7.2	4.2
	(15)	(15)	(15)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(13)	(12)

Soil Climatic Parameters (50 cm Depth)

MAST = 8.1 C
DEGREE-DAYS > 5 C = 1517.
DEGREE-DAYS > 15 C = 28.
CLASS = Moderately Cool BOREAL

MSST = 14.2 C
DAYS > 5 C = 224.
DAYS > 15 C = 54.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = 0.4 C
Extreme Lowest Temp. = -0.3 C
Lowest 1 year in 10 (10% Risk) = -0.24 C
Lowest 1 year in 5 (20% Risk) = 0.04 C
Probability of Temp =< 0.00 C = 18.8%
Years of Data = 15

EDDY POINT 8201716 Period : 1973-1985

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.4	-0.1	0.1	1.6	6.9	12.6	16.8	17.6	14.9	10.5	6.1	2.5
	(13)	(13)	(13)	(12)	(12)	(12)	(12)	(12)	(12)	(12)	(12)	(12)
50cm	1.9	1.1	0.9	1.5	5.6	10.4	14.5	15.8	14.5	11.2	7.3	4.0
	(13)	(13)	(13)	(12)	(12)	(12)	(12)	(12)	(12)	(12)	(12)	(12)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.4 C
DEGREE-DAYS > 5 C = 1369.
DEGREE-DAYS > 15 C = 32.
CLASS = Cool BOREAL

MSST = 13.7 C
DAYS > 5 C = 208.
DAYS > 15 C = 52.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.4 C
Extreme Lowest Temp. = -4.4 C
Lowest 1 year in 10 (10% Risk) = -3.00 C
Lowest 1 year in 5 (20% Risk) = -0.58 C
Probability of Temp =< 0.00 C = 46.4%
Probability of Temp =< -1.00 C = 14.1%
Probability of Temp =< -2.00 C = 12.0%
Years of Data = 13

NOVA SCOTIA

GREENWOOD A 8202000 Period : 1956-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.8	0.1	0.4	4.7	11.4	17.0	20.2	19.6	15.9	10.3	6.0	2.4
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)
50cm	2.0	1.2	1.0	3.7	9.5	14.6	17.9	18.3	15.9	11.4	7.4	3.9
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)

Soil Climatic Parameters (50 cm Depth)

MAST = 9.0 C
DEGREE-DAYS > 5 C = 1845.
DEGREE-DAYS > 15 C = 235.
CLASS = Mild MESIC

MSST = 17.0 C
DAYS > 5 C = 224.
DAYS > 15 C = 98.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = 0.0 C
Extreme Lowest Temp. = -3.2 C
Lowest 1 year in 10 (10% Risk) = -0.68 C
Lowest 1 year in 5 (20% Risk) = -0.50 C
Probability of Temp =< 0.00 C = 43.8%
Probability of Temp =< -1.00 C = 7.5%
Probability of Temp =< -2.00 C = 5.0%
Years of Data = 31

HALIFAX INT'L A 8202250 Period : 1961-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.2	-0.4	0.1	3.0	9.3	14.9	18.4	18.6	15.4	10.5	5.5	1.9
	(26)	(26)	(26)	(26)	(26)	(26)	(26)	(26)	(26)	(26)	(26)	(26)
50cm	1.7	0.9	0.7	2.4	7.5	12.5	16.2	17.1	15.2	11.1	7.0	3.6
	(26)	(26)	(26)	(26)	(26)	(26)	(26)	(26)	(26)	(26)	(26)	(26)

Soil Climatic Parameters (50 cm Depth)

MAST = 8.0 C
DEGREE-DAYS > 5 C = 1581.
DEGREE-DAYS > 15 C = 118.
CLASS = Moderately Cool BOREAL

MSST = 15.3 C
DAYS > 5 C = 214.
DAYS > 15 C = 78.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.5 C
Extreme Lowest Temp. = -2.9 C
Lowest 1 year in 10 (10% Risk) = -1.77 C
Lowest 1 year in 5 (20% Risk) = -0.96 C
Probability of Temp =< 0.00 C = 70.4%
Probability of Temp =< -1.00 C = 18.5%
Probability of Temp =< -2.00 C = 9.1%
Years of Data = 26

NOVA SCOTIA

INGONISH BEACH 8202500 Period : 1962-1980

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	1.6	1.3	1.0	3.3	7.9	13.5	17.3	18.0	15.2	10.7	6.0	2.4
	(13)	(11)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(8)	(8)
50cm	2.3	1.6	1.3	2.3	6.2	11.1	14.9	16.3	14.9	11.6	7.3	3.9
	(13)	(11)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(8)	(8)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.8 C
DEGREE-DAYS > 5 C = 1451.
DEGREE-DAYS > 15 C = 57.
CLASS = Moderately Cool BOREAL

MSST = 14.2 C
DAYS > 5 C = 211.
DAYS > 15 C = 62.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = 0.8 C
Extreme Lowest Temp. = -0.6 C
Lowest 1 year in 10 (10% Risk) = -0.60 C
Lowest 1 year in 5 (20% Risk) = 0.40 C
Probability of Temp =< 0.00 C = 16.0%
Years of Data = 9

KENTVILLE CDA 8202800 Period : 1961-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.7	0.2	0.5	4.4	10.7	16.4	19.7	19.2	15.8	10.9	5.9	2.4
	(23)	(23)	(22)	(22)	(22)	(22)	(22)	(22)	(22)	(21)	(20)	(20)
50cm	1.9	1.3	1.0	3.4	9.0	14.1	17.5	18.0	15.6	11.7	7.2	3.8
	(23)	(23)	(22)	(22)	(22)	(22)	(22)	(22)	(22)	(21)	(20)	(20)

Soil Climatic Parameters (50 cm Depth)

MAST = 8.8 C
DEGREE-DAYS > 5 C = 1778.
DEGREE-DAYS > 15 C = 197.
CLASS = Mild MESIC

MSST = 16.6 C
DAYS > 5 C = 221.
DAYS > 15 C = 92.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = 0.1 C
Extreme Lowest Temp. = -0.9 C
Lowest 1 year in 10 (10% Risk) = -0.64 C
Lowest 1 year in 5 (20% Risk) = -0.34 C
Probability of Temp =< 0.00 C = 41.3%
Years of Data = 22

NOVA SCOTIA

MARGAREE FORKS 8203423 Period : 1962-1980

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.7	-0.1	0.2	1.9	7.8	13.8	17.3	18.0	14.4	10.1	5.8	2.4
	(18)	(17)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(15)	(15)
50cm	2.0	1.2	0.8	1.8	6.1	11.5	14.6	16.1	14.2	10.9	7.2	4.0
	(18)	(17)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(15)	(15)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.6 C
MSST = 14.1 C
DEGREE-DAYS > 5 C = 1404.
DAYS > 5 C = 209.
DEGREE-DAYS > 15 C = 40.
DAYS > 15 C = 49.
CLASS = Cool to Moderately Cool BOREAL

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.3 C
Extreme Lowest Temp. = -2.3 C
Lowest 1 year in 10 (10% Risk) = -2.02 C
Lowest 1 year in 5 (20% Risk) = -1.36 C
Probability of Temp =< 0.00 C = 47.1%
Probability of Temp =< -1.00 C = 25.3%
Probability of Temp =< -2.00 C = 10.3%
Years of Data = 16

METEGHAN RIVER 8203500 Period : 1972-1980

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	1.1	0.5	1.2	5.7	9.7	13.8	16.0	16.1	14.5	10.8	6.7	3.0
	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(8)	(8)
50cm	2.2	1.4	1.4	4.0	8.1	11.3	13.9	14.6	13.8	11.3	7.4	4.3
	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(8)	(8)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.8 C
MSST = 13.3 C
DEGREE-DAYS > 5 C = 1393.
DAYS > 5 C = 227.
DEGREE-DAYS > 15 C = 0.
DAYS > 15 C = 0.
CLASS = Cool BOREAL

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = 0.4 C
Extreme Lowest Temp. = -0.1 C
Lowest 1 year in 10 (10% Risk) = -0.10 C
Lowest 1 year in 5 (20% Risk) = 0.10 C
Probability of Temp =< 0.00 C = 15.0%
Years of Data = 9

NOVA SCOTIA

NAPPAN CDA 8203700 Period : 1960-1983

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	-0.2	-0.7	0.0	2.7	9.6	15.3	18.3	18.3	15.2	10.2	5.1	1.5
	(24)	(24)	(24)	(23)	(23)	(23)	(23)	(23)	(23)	(23)	(22)	(22)
50cm	1.5	0.7	0.7	2.2	7.4	12.6	15.8	16.7	14.9	11.0	6.7	3.2
	(24)	(24)	(24)	(23)	(23)	(23)	(23)	(23)	(23)	(23)	(22)	(22)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.8 C
DEGREE-DAYS > 5 C = 1532.
DEGREE-DAYS > 15 C = 86.
CLASS = Moderately Cool BOREAL

MSST = 15.1 C
DAYS > 5 C = 210.
DAYS > 15 C = 72.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.8 C
Extreme Lowest Temp. = -3.7 C
Lowest 1 year in 10 (10% Risk) = -2.75 C
Lowest 1 year in 5 (20% Risk) = -1.60 C
Probability of Temp =< 0.00 C = 84.0%
Probability of Temp =< -1.00 C = 32.0%
Probability of Temp =< -2.00 C = 16.8%
Years of Data = 24

PARRSBORO 8204400 Period : 1960-1979

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.3	-0.4	0.1	2.8	9.6	14.8	17.4	17.5	14.8	10.0	5.0	1.5
	(20)	(20)	(19)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(15)
50cm	1.6	0.8	0.7	2.0	7.2	12.0	14.8	15.8	14.5	10.6	6.7	3.2
	(20)	(20)	(19)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(15)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.5 C
DEGREE-DAYS > 5 C = 1428.
DEGREE-DAYS > 15 C = 35.
CLASS = Cool BOREAL

MSST = 14.3 C
DAYS > 5 C = 210.
DAYS > 15 C = 55.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.6 C
Extreme Lowest Temp. = -2.9 C
Lowest 1 year in 10 (10% Risk) = -2.50 C
Lowest 1 year in 5 (20% Risk) = -1.70 C
Probability of Temp =< 0.00 C = 68.3%
Probability of Temp =< -1.00 C = 28.0%
Probability of Temp =< -2.00 C = 15.0%
Years of Data = 19

NOVA SCOTIA

PORT HOOD 8204500 Period : 1962-1980

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.3	-0.8	-0.3	0.7	5.6	11.9	17.2	18.0	14.9	10.5	6.1	2.9
	(16)	(16)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(9)	(9)	(9)
50cm	1.7	0.7	0.2	0.4	3.6	8.6	13.5	15.8	14.4	11.5	6.9	4.0
	(16)	(16)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(9)	(9)	(9)

Soil Climatic Parameters (50 cm Depth)

MAST = 6.8 C
DEGREE-DAYS > 5 C = 1251.
DEGREE-DAYS > 15 C = 25.
CLASS = Moderately Cold CRYOBOREAL

MSST = 12.8 C
DAYS > 5 C = 194.
DAYS > 15 C = 41.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -1.4 C
Extreme Lowest Temp. = -3.4 C
Lowest 1 year in 10 (10% Risk) = -3.36 C
Lowest 1 year in 5 (20% Risk) = -2.76 C
Probability of Temp =< 0.00 C = 86.1%
Probability of Temp =< -1.00 C = 61.1%
Probability of Temp =< -2.00 C = 33.3%
Years of Data = 11

RIVER DENYS 8204565 Period : 1972-1980

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.6	-0.3	0.5	2.6	8.8	15.1	18.5	18.6	14.7	9.6	5.6	2.5
	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(7)	(6)	(5)
50cm	1.7	0.9	0.9	1.9	6.8	12.5	15.8	16.9	14.8	10.9	6.8	3.8
	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(7)	(6)	(5)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.8 C
DEGREE-DAYS > 5 C = 1515.
DEGREE-DAYS > 15 C = 91.
CLASS = Moderately Cool BOREAL

MSST = 15.1 C
DAYS > 5 C = 211.
DAYS > 15 C = 70.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.3 C
Extreme Lowest Temp. = -1.2 C
Lowest 1 year in 10 (10% Risk) = -1.08 C
Lowest 1 year in 5 (20% Risk) = -1.04 C
Probability of Temp =< 0.00 C = 60.0%
Probability of Temp =< -1.00 C = 22.2%
Years of Data = 8

NOVA SCOTIA

SHEARWATER A 8205090 Period : 1956-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.6	0.1	0.4	3.6	9.0	13.9	17.2	17.8	15.4	11.1	6.3	2.6
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)
50cm	2.0	1.1	1.0	2.9	7.5	11.6	15.2	16.2	14.9	11.6	7.5	4.1
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)

Soil Climatic Parameters (50 cm Depth)

MAST = 8.0 C
DEGREE-DAYS > 5 C = 1515.
DEGREE-DAYS > 15 C = 59.
CLASS = Moderately Cool BOREAL

MSST = 14.4 C
DAYS > 5 C = 219.
DAYS > 15 C = 66.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.1 C
Extreme Lowest Temp. = -1.3 C
Lowest 1 year in 10 (10% Risk) = -1.08 C
Lowest 1 year in 5 (20% Risk) = -0.50 C
Probability of Temp =< 0.00 C = 53.1%
Probability of Temp =< -1.00 C = 12.5%
Years of Data = 31

SYDNEY A 8205700 Period : 1956-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.4	-0.2	0.1	1.6	7.3	13.2	17.3	18.0	14.8	10.2	5.8	2.4
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)
50cm	1.9	1.1	0.9	1.9	6.1	11.1	15.1	16.2	14.5	10.9	7.3	4.0
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.6 C
DEGREE-DAYS > 5 C = 1422.
DEGREE-DAYS > 15 C = 54.
CLASS = Cool to Moderately Cool BOREAL

MSST = 14.2 C
DAYS > 5 C = 210.
DAYS > 15 C = 59.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.3 C
Extreme Lowest Temp. = -2.3 C
Lowest 1 year in 10 (10% Risk) = -1.70 C
Lowest 1 year in 5 (20% Risk) = -0.82 C
Probability of Temp =< 0.00 C = 62.5%
Probability of Temp =< -1.00 C = 17.7%
Probability of Temp =< -2.00 C = 5.5%
Years of Data = 31

NOVA SCOTIA

TRAFALGAR 8205900 Period : 1963-1980

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.1	-0.9	-0.2	1.5	8.1	14.4	17.7	18.4	14.8	9.4	4.6	1.3
	(19)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)
50cm	1.3	0.6	0.6	1.4	6.2	11.9	15.2	16.7	14.8	10.8	6.2	2.8
	(19)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.4 C
DEGREE-DAYS > 5 C = 1442.
DEGREE-DAYS > 15 C = 73.
CLASS = Cool to Moderately Cool BOREAL

MSST = 14.7 C
DAYS > 5 C = 199.
DAYS > 15 C = 64.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -1.0 C
Extreme Lowest Temp. = -4.6 C
Lowest 1 year in 10 (10% Risk) = -2.35 C
Lowest 1 year in 5 (20% Risk) = -1.80 C
Probability of Temp =< 0.00 C = 73.7%
Probability of Temp =< -1.00 C = 48.7%
Probability of Temp =< -2.00 C = 12.3%
Years of Data = 18

TRURO 8205990 Period : 1961-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	-0.1	-0.7	-0.1	2.5	9.3	15.0	18.3	18.3	14.8	9.9	5.3	1.7
	(24)	(24)	(23)	(22)	(22)	(22)	(22)	(22)	(22)	(19)	(19)	(17)
50cm	1.5	0.7	0.6	2.0	7.1	12.3	15.9	16.7	14.6	10.9	7.0	3.4
	(24)	(24)	(23)	(22)	(22)	(22)	(22)	(22)	(22)	(19)	(19)	(17)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.8 C
DEGREE-DAYS > 5 C = 1519.
DEGREE-DAYS > 15 C = 87.
CLASS = Moderately Cool BOREAL

MSST = 15.0 C
DAYS > 5 C = 211.
DAYS > 15 C = 69.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.8 C
Extreme Lowest Temp. = -2.4 C
Lowest 1 year in 10 (10% Risk) = -2.30 C
Lowest 1 year in 5 (20% Risk) = -1.82 C
Probability of Temp =< 0.00 C = 70.8%
Probability of Temp =< -1.00 C = 43.8%
Probability of Temp =< -2.00 C = 15.6%
Years of Data = 23

NOVA SCOTIA

WEYMOUTH FALLS 8206275 Period : 1966-1980

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.9	0.4	0.8	5.0	10.5	15.6	18.4	18.3	15.9	10.9	6.6	3.4
	(11)	(11)	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(7)	(6)
50cm	2.1	1.3	1.2	3.6	8.4	13.0	15.9	16.8	15.5	11.6	7.6	4.6
	(11)	(11)	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(7)	(6)

Soil Climatic Parameters (50 cm Depth)

MAST = 8.5 C
DEGREE-DAYS > 5 C = 1650.
DEGREE-DAYS > 15 C = 102.
CLASS = Moderately Cool BOREAL

MSST = 15.3 C
DAYS > 5 C = 229.
DAYS > 15 C = 80.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = 0.3 C
Extreme Lowest Temp. = -0.6 C
Lowest 1 year in 10 (10% Risk) = -0.57 C
Lowest 1 year in 5 (20% Risk) = -0.28 C
Probability of Temp =< 0.00 C = 31.8%
Years of Data = 10

YARMOUTH A 8206500 Period : 1956-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	1.2	0.8	1.0	5.3	9.7	14.0	16.4	16.6	14.8	10.9	6.7	3.3
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)
50cm	2.3	1.5	1.5	4.1	8.2	11.5	14.3	15.0	14.1	11.2	7.6	4.5
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)

Soil Climatic Parameters (50 cm Depth)

MAST = 8.0 C
DEGREE-DAYS > 5 C = 1449.
DEGREE-DAYS > 15 C = 2.
CLASS = Cool to Moderately Cool BOREAL

MSST = 13.7 C
DAYS > 5 C = 231.
DAYS > 15 C = 21.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = 0.6 C
Extreme Lowest Temp. = -0.6 C
Lowest 1 year in 10 (10% Risk) = -0.06 C
Lowest 1 year in 5 (20% Risk) = 0.14 C
Probability of Temp =< 0.00 C = 10.9%
Years of Data = 31

PEI

ALBERTON 8300080 Period : 1972-1980

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.0	-0.8	0.0	0.7	6.2	13.3	17.4	18.0	14.4	9.6	4.2	1.2
	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(8)	(8)
50cm	1.5	0.7	0.6	0.7	4.8	10.7	14.6	16.1	14.3	10.6	6.0	3.0
	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(8)	(8)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.0 C
DEGREE-DAYS > 5 C = 1315.
DEGREE-DAYS > 15 C = 41.
CLASS = Cool BOREAL

MSST = 13.9 C
DAYS > 5 C = 190.
DAYS > 15 C = 51.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -1.0 C
Extreme Lowest Temp. = -7.1 C
Lowest 1 year in 10 (10% Risk) = -7.10 C
Lowest 1 year in 5 (20% Risk) = -1.10 C
Probability of Temp =< 0.00 C = 60.0%
Probability of Temp =< -1.00 C = 25.0%
Probability of Temp =< -2.00 C = 18.5%
Probability of Temp =< -5.00 C = 13.5%
Years of Data = 9

ALLISTON CDA EPF 8300100 Period : 1962-1977

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.2	-0.1	0.3	2.1	8.3	14.6	18.3	18.6	15.1	10.5	5.3	1.7
	(18)	(17)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(16)
50cm	1.7	1.1	0.8	1.7	6.4	11.9	15.8	16.9	14.9	11.2	6.8	3.4
	(18)	(17)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(16)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.7 C
DEGREE-DAYS > 5 C = 1502.
DEGREE-DAYS > 15 C = 95.
CLASS = Moderately Cool BOREAL

MSST = 14.9 C
DAYS > 5 C = 205.
DAYS > 15 C = 70.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.3 C
Extreme Lowest Temp. = -2.0 C
Lowest 1 year in 10 (10% Risk) = -1.86 C
Lowest 1 year in 5 (20% Risk) = -1.60 C
Probability of Temp =< 0.00 C = 47.1%
Probability of Temp =< -1.00 C = 28.6%
Probability of Temp =< -2.00 C = 5.9%
Years of Data = 16

PEI

BANGOR 8300128 Period : 1973-1981

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	-0.2	-0.5	0.0	1.4	7.7	14.1	17.9	18.3	14.6	9.7	4.8	1.3
	(9)	(9)	(9)	(8)	(8)	(8)	(8)	(8)	(8)	(-8)	(8)	(8)
50cm	1.3	0.5	0.5	0.9	5.7	11.3	15.0	16.4	14.4	10.9	6.2	2.9
	(9)	(9)	(9)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.2 C
DEGREE-DAYS > 5 C = 1393.
DEGREE-DAYS > 15 C = 58.
CLASS = Cool BOREAL

MSST = 14.3 C
DAYS > 5 C = 196.
DAYS > 15 C = 58.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.8 C
Extreme Lowest Temp. = -2.6 C
Lowest 1 year in 10 (10% Risk) = -2.60 C
Lowest 1 year in 5 (20% Risk) = -2.10 C
Probability of Temp =< 0.00 C = 75.0%
Probability of Temp =< -1.00 C = 40.0%
Probability of Temp =< -2.00 C = 21.7%
Years of Data = 9

CHARLOTTETOWN A 8300300 Period : 1956-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.1	-0.4	0.2	2.1	8.3	14.2	17.8	18.0	14.6	10.1	5.3	1.6
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)
50cm	1.7	1.0	0.9	1.8	6.6	11.6	15.3	16.3	14.4	10.8	6.9	3.4
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.6 C
DEGREE-DAYS > 5 C = 1439.
DEGREE-DAYS > 15 C = 59.
CLASS = Moderately Cool BOREAL

MSST = 14.5 C
DAYS > 5 C = 208.
DAYS > 15 C = 61.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.5 C
Extreme Lowest Temp. = -4.9 C
Lowest 1 year in 10 (10% Risk) = -3.08 C
Lowest 1 year in 5 (20% Risk) = -1.52 C
Probability of Temp =< 0.00 C = 50.0%
Probability of Temp =< -1.00 C = 28.1%
Probability of Temp =< -2.00 C = 15.6%
Years of Data = 31

PEI

CHARLOTTETOWN CDA 8300400 Period : 1960-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.0	-0.5	0.1	2.1	8.3	14.4	18.0	18.2	14.9	10.5	5.5	1.8
	(26)	(26)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(23)	(23)	(23)
50cm	1.6	0.9	0.9	2.0	6.8	11.8	15.4	16.5	14.6	11.2	6.8	3.4
	(26)	(26)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(23)	(23)	(23)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.7 C
DEGREE-DAYS > 5 C = 1477.
DEGREE-DAYS > 15 C = 68.
CLASS = Moderately Cool BOREAL

MSST = 14.6 C
DAYS > 5 C = 208.
DAYS > 15 C = 63.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.6 C
Extreme Lowest Temp. = -4.2 C
Lowest 1 year in 10 (10% Risk) = -2.28 C
Lowest 1 year in 5 (20% Risk) = -1.56 C
Probability of Temp =< 0.00 C = 57.7%
Probability of Temp =< -1.00 C = 35.9%
Probability of Temp =< -2.00 C = 11.5%
Years of Data = 25

EAST BALTIC 8300416 Period : 1973-1980

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	-0.2	-0.3	0.1	0.9	6.4	13.0	16.9	17.6	14.3	9.9	5.2	1.6
	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(7)	(7)
50cm	1.5	1.0	0.7	0.9	4.9	10.4	14.1	15.6	13.9	10.9	6.4	3.3
	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(7)	(7)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.0 C
DEGREE-DAYS > 5 C = 1285.
DEGREE-DAYS > 15 C = 19.
CLASS = Moderately Cold CRYOBOREAL to Cool BOREAL

MSST = 13.5 C
DAYS > 5 C = 195.
DAYS > 15 C = 37.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.8 C
Extreme Lowest Temp. = -2.5 C
Lowest 1 year in 10 (10% Risk) = -2.25 C
Lowest 1 year in 5 (20% Risk) = -2.02 C
Probability of Temp =< 0.00 C = 66.7%
Probability of Temp =< -1.00 C = 46.0%
Probability of Temp =< -2.00 C = 20.4%
Years of Data = 8

PEI

HUNTER RIVER 8300439 Period : 1973-1980

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	-0.1	-0.8	-0.1	1.7	8.2	14.6	18.1	18.3	14.7	9.9	4.7	1.3
	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(7)	(7)
50cm	1.4	0.5	0.4	1.2	6.2	11.7	15.3	16.6	14.5	11.0	6.1	3.0
	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(7)	(7)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.4 C
DEGREE-DAYS > 5 C = 1432.
DEGREE-DAYS > 15 C = 69.
CLASS = Cool to Moderately Cool BOREAL

MSST = 14.6 C
DAYS > 5 C = 198.
DAYS > 15 C = 62.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -1.1 C
Extreme Lowest Temp. = -6.0 C
Lowest 1 year in 10 (10% Risk) = -5.40 C
Lowest 1 year in 5 (20% Risk) = -2.80 C
Probability of Temp =< 0.00 C = 78.5%
Probability of Temp =< -1.00 C = 35.6%
Probability of Temp =< -2.00 C = 22.2%
Probability of Temp =< -5.00 C = 13.9%
Years of Data = 8

MONTICELLO ARMADALE 8300447 Period : 1963-1981

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.5	-0.3	0.0	1.2	6.8	13.1	17.1	17.6	14.5	10.2	5.3	1.8
	(19)	(19)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(17)	(17)
50cm	1.8	0.9	0.5	1.1	5.0	10.6	14.2	15.7	14.2	11.1	6.7	3.4
	(19)	(19)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(17)	(17)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.1 C
DEGREE-DAYS > 5 C = 1320.
DEGREE-DAYS > 15 C = 23.
CLASS = Moderately Cold CRYOBOREAL to Cool BOREAL

MSST = 13.6 C
DAYS > 5 C = 197.
DAYS > 15 C = 42.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.8 C
Extreme Lowest Temp. = -3.8 C
Lowest 1 year in 10 (10% Risk) = -3.44 C
Lowest 1 year in 5 (20% Risk) = -1.82 C
Probability of Temp =< 0.00 C = 64.9%
Probability of Temp =< -1.00 C = 47.4%
Probability of Temp =< -2.00 C = 19.1%
Years of Data = 18

PEI

NEW LONDON 8300500 Period : 1971-1980

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	-0.4	-0.8	-0.2	1.4	7.6	14.1	17.7	18.0	14.8	9.9	4.5	1.0
	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(8)	(8)
50cm	1.4	0.5	0.4	1.1	5.6	11.3	14.7	16.1	14.6	10.9	6.0	2.8
	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(8)	(8)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.2 C
DEGREE-DAYS > 5 C = 1368.
DEGREE-DAYS > 15 C = 44.
CLASS = Cool BOREAL

MSST = 14.1 C
DAYS > 5 C = 194.
DAYS > 15 C = 54.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -1.2 C
Extreme Lowest Temp. = -3.2 C
Lowest 1 year in 10 (10% Risk) = -3.20 C
Lowest 1 year in 5 (20% Risk) = -3.00 C
Probability of Temp =< 0.00 C = 73.8%
Probability of Temp =< -1.00 C = 60.0%
Probability of Temp =< -2.00 C = 34.6%
Years of Data = 9

O'LEARY 8300525 Period : 1962-1980

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.0	-0.3	0.1	1.6	7.9	14.3	17.7	17.9	14.6	9.8	4.4	1.1
	(19)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(17)	(17)
50cm	1.6	0.8	0.7	1.3	6.0	11.5	15.1	16.2	14.4	10.7	6.0	2.9
	(19)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(17)	(17)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.3 C
DEGREE-DAYS > 5 C = 1384.
DEGREE-DAYS > 15 C = 49.
CLASS = Cool BOREAL

MSST = 14.3 C
DAYS > 5 C = 196.
DAYS > 15 C = 58.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.8 C
Extreme Lowest Temp. = -3.5 C
Lowest 1 year in 10 (10% Risk) = -3.41 C
Lowest 1 year in 5 (20% Risk) = -2.82 C
Probability of Temp =< 0.00 C = 52.6%
Probability of Temp =< -1.00 C = 42.1%
Probability of Temp =< -2.00 C = 25.3%
Years of Data = 18

PEI

SUMMERSIDE A 8300700 Period : 1956-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	-0.2	-0.4	0.2	2.1	8.4	14.4	18.2	18.3	14.9	10.3	5.2	1.4
	(31)	(31)	(31)	(30)	(30)	(30)	(30)	(30)	(30)	(30)	(30)	(30)
50cm	1.5	0.9	0.8	1.8	6.7	11.7	15.7	16.6	14.6	11.0	6.7	3.3
	(31)	(31)	(31)	(30)	(30)	(30)	(30)	(30)	(30)	(30)	(30)	(30)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.6 C
DEGREE-DAYS > 5 C = 1471.
DEGREE-DAYS > 15 C = 78.
CLASS = Moderately Cool BOREAL

MSST = 14.7 C
DAYS > 5 C = 206.
DAYS > 15 C = 66.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.6 C
Extreme Lowest Temp. = -4.0 C
Lowest 1 year in 10 (10% Risk) = -2.58 C
Lowest 1 year in 5 (20% Risk) = -1.50 C
Probability of Temp =< 0.00 C = 56.3%
Probability of Temp =< -1.00 C = 29.7%
Probability of Temp =< -2.00 C = 16.8%
Years of Data = 31

TIGNISH 8300800 Period : 1973-1984

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	-0.2	-1.4	-0.3	0.6	6.8	13.8	18.0	18.4	14.5	9.7	4.6	1.5
	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(7)	(7)
50cm	1.5	0.2	0.3	0.5	5.1	11.2	15.2	16.5	14.4	10.7	6.1	3.1
	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(7)	(7)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.1 C
DEGREE-DAYS > 5 C = 1378.
DEGREE-DAYS > 15 C = 66.
CLASS = Cool BOREAL

MSST = 14.4 C
DAYS > 5 C = 192.
DAYS > 15 C = 60.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -1.5 C
Extreme Lowest Temp. = -4.7 C
Lowest 1 year in 10 (10% Risk) = -4.70 C
Lowest 1 year in 5 (20% Risk) = -3.80 C
Probability of Temp =< 0.00 C = 68.3%
Probability of Temp =< -1.00 C = 46.7%
Probability of Temp =< -2.00 C = 35.4%
Years of Data = 9

NEWFOUNDLAND

COLINET 8401200 Period : 1962-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	1.1	0.6	0.5	2.9	7.4	10.9	14.1	14.9	13.1	9.3	5.7	2.5
	(20)	(20)	(19)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(12)	(12)
50cm	2.0	1.2	1.2	2.4	5.5	8.5	11.1	13.0	12.6	9.8	6.9	3.9
	(20)	(20)	(19)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(12)	(12)

Soil Climatic Parameters (50 cm Depth)

MAST = 6.5 C
MSST = 10.9 C
DEGREE-DAYS > 5 C = 998.
DAYS > 5 C = 206.
DEGREE-DAYS > 15 C = 0.
DAYS > 15 C = 0.
CLASS = Cold to Moderately Cold CRYOBOREAL

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = 0.4 C
Extreme Lowest Temp. = -1.4 C
Lowest 1 year in 10 (10% Risk) = -0.90 C
Lowest 1 year in 5 (20% Risk) = 0.10 C
Probability of Temp =< 0.00 C = 19.4%
Probability of Temp =< -1.00 C = 9.0%
Years of Data = 19

COMFORT COVE 8401259 Period : 1968-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.1	-0.3	0.2	1.5	6.5	11.9	16.4	16.4	12.5	8.5	4.0	1.0
	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(16)	(16)	(16)
50cm	1.6	1.0	0.7	1.2	4.9	10.1	14.0	14.7	12.6	9.5	5.7	2.8
	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(18)	(16)	(16)	(16)

Soil Climatic Parameters (50 cm Depth)

MAST = 6.6 C
MSST = 13.0 C
DEGREE-DAYS > 5 C = 1143.
DAYS > 5 C = 190.
DEGREE-DAYS > 15 C = 0.
DAYS > 15 C = 0.
CLASS = Moderately Cold CRYOBOREAL

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.5 C
Extreme Lowest Temp. = -4.5 C
Lowest 1 year in 10 (10% Risk) = -2.16 C
Lowest 1 year in 5 (20% Risk) = -1.18 C
Probability of Temp =< 0.00 C = 63.2%
Probability of Temp =< -1.00 C = 23.7%
Probability of Temp =< -2.00 C = 10.3%
Years of Data = 18

NEWFOUNDLAND

DEER LAKE 8401500 Period : 1966-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.8	0.1	0.2	1.8	7.6	13.1	17.1	17.1	12.8	8.7	4.0	1.2
	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(19)	(19)	(19)
50cm	1.6	0.9	0.8	1.5	5.6	10.9	14.7	15.5	13.2	10.2	5.8	2.8
	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(19)	(19)	(19)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.0 C
DEGREE-DAYS > 5 C = 1265.
DEGREE-DAYS > 15 C = 20.
CLASS = Moderately Cold CRYOBOREAL

MSST = 13.8 C
DAYS > 5 C = 193.
DAYS > 15 C = 42.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.2 C
Extreme Lowest Temp. = -6.2 C
Lowest 1 year in 10 (10% Risk) = -1.08 C
Lowest 1 year in 5 (20% Risk) = -0.36 C
Probability of Temp =< 0.00 C = 38.1%
Probability of Temp =< -1.00 C = 11.9%
Probability of Temp =< -2.00 C = 8.7%
Probability of Temp =< -5.00 C = 5.9%
Years of Data = 20

GANDER INT'L A 8401700 Period : 1956-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.0	-0.2	0.3	1.4	6.7	12.0	16.3	16.4	12.7	8.7	4.3	1.2
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)
50cm	1.6	1.0	1.0	1.3	5.1	10.1	13.8	14.7	12.7	9.7	6.0	3.0
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)

Soil Climatic Parameters (50 cm Depth)

MAST = 6.7 C
DEGREE-DAYS > 5 C = 1154.
DEGREE-DAYS > 15 C = 0.
CLASS = Moderately Cold CRYOBOREAL

MSST = 12.9 C
DAYS > 5 C = 193.
DAYS > 15 C = 0.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.5 C
Extreme Lowest Temp. = -5.6 C
Lowest 1 year in 10 (10% Risk) = -1.82 C
Lowest 1 year in 5 (20% Risk) = -1.16 C
Probability of Temp =< 0.00 C = 56.3%
Probability of Temp =< -1.00 C = 31.3%
Probability of Temp =< -2.00 C = 6.2%
Probability of Temp =< -5.00 C = 3.6%
Years of Data = 31

NEWFOUNDLAND

PORT AUX BASQUES 8402975 Period : 1961-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.7	0.4	0.4	1.0	5.5	9.6	13.7	14.6	12.6	8.9	5.3	2.3
	(24)	(23)	(23)	(23)	(23)	(23)	(23)	(23)	(23)	(22)	(22)	(22)
50cm	1.9	1.3	1.2	1.0	3.9	7.4	10.3	12.2	11.9	9.4	6.3	3.6
	(24)	(23)	(23)	(23)	(23)	(23)	(23)	(23)	(23)	(22)	(22)	(22)

Soil Climatic Parameters (50 cm Depth)

MAST = 5.9 C
DEGREE-DAYS > 5 C = 844.
DEGREE-DAYS > 15 C = 0.
CLASS = Cold CRYOBOREAL

MSST = 10.0 C
DAYS > 5 C = 188.
DAYS > 15 C = 0.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = 0.0 C
Extreme Lowest Temp. = -2.5 C
Lowest 1 year in 10 (10% Risk) = -1.54 C
Lowest 1 year in 5 (20% Risk) = -0.82 C
Probability of Temp =< 0.00 C = 41.7%
Probability of Temp =< -1.00 C = 12.5%
Probability of Temp =< -2.00 C = 7.6%
Years of Data = 23

ST ALBANS 8403290 Period : 1970-1983

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.5	0.0	0.0	2.0	7.5	12.4	15.5	16.3	13.7	9.2	5.1	1.8
	(14)	(14)	(14)	(13)	(13)	(13)	(13)	(13)	(13)	(13)	(13)	(13)
50cm	1.8	1.0	1.1	2.2	6.2	10.3	13.3	14.6	13.7	10.0	6.9	3.5
	(14)	(14)	(14)	(13)	(13)	(13)	(13)	(13)	(13)	(13)	(13)	(13)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.1 C
DEGREE-DAYS > 5 C = 1224.
DEGREE-DAYS > 15 C = 0.
CLASS = Moderately Cold CRYOBOREAL

MSST = 12.8 C
DAYS > 5 C = 208.
DAYS > 15 C = 0.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.3 C
Extreme Lowest Temp. = -1.8 C
Lowest 1 year in 10 (10% Risk) = -1.75 C
Lowest 1 year in 5 (20% Risk) = -0.80 C
Probability of Temp =< 0.00 C = 53.3%
Probability of Temp =< -1.00 C = 18.5%
Years of Data = 14

NEWFOUNDLAND

ST JOHN'S A 8403506 Period : 1956-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.7	0.4	0.3	1.6	6.4	11.1	15.4	15.8	13.1	9.1	5.4	2.2
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)
50cm	2.0	1.4	1.1	1.7	5.0	9.3	12.8	14.0	12.9	10.0	7.0	3.9
	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)

Soil Climatic Parameters (50 cm Depth)

MAST = 6.8 C
DEGREE-DAYS > 5 C = 1118.
DEGREE-DAYS > 15 C = 0.
CLASS = Moderately Cold CRYOBOREAL

MSST = 12.1 C
DAYS > 5 C = 202.
DAYS > 15 C = 0.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = 0.2 C
Extreme Lowest Temp. = -1.4 C
Lowest 1 year in 10 (10% Risk) = -0.68 C
Lowest 1 year in 5 (20% Risk) = -0.32 C
Probability of Temp =< 0.00 C = 34.4%
Probability of Temp =< -1.00 C = 7.8%
Years of Data = 31

ST JOHN'S WEST CDA 8403600 Period : 1961-1983

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.8	0.5	0.3	1.5	6.4	11.7	15.5	15.7	13.3	9.5	5.7	2.5
	(22)	(22)	(21)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(18)
50cm	2.1	1.4	1.2	1.7	5.1	9.4	12.9	14.0	12.9	10.2	7.1	4.1
	(22)	(22)	(21)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(18)

Soil Climatic Parameters (50 cm Depth)

MAST = 6.9 C
DEGREE-DAYS > 5 C = 1135.
DEGREE-DAYS > 15 C = 0.
CLASS = Moderately Cold CRYOBOREAL

MSST = 12.2 C
DAYS > 5 C = 204.
DAYS > 15 C = 0.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = 0.1 C
Extreme Lowest Temp. = -2.7 C
Lowest 1 year in 10 (10% Risk) = -0.96 C
Lowest 1 year in 5 (20% Risk) = -0.22 C
Probability of Temp =< 0.00 C = 36.4%
Probability of Temp =< -1.00 C = 9.7%
Probability of Temp =< -2.00 C = 6.5%
Years of Data = 21

NEWFOUNDLAND

ST LAWRENCE 8403615 Period : 1967-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.9	0.4	0.4	1.7	6.3	9.8	13.5	14.3	13.1	9.2	5.3	2.4
	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(18)	(18)	(18)
50cm	2.0	1.3	1.2	1.7	4.8	7.7	10.4	12.2	12.5	9.5	6.7	3.8
	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(19)	(18)	(18)	(18)

Soil Climatic Parameters (50 cm Depth)

MAST = 6.2 C
DEGREE-DAYS > 5 C = 895.
DEGREE-DAYS > 15 C = 0.
CLASS = Cold to Moderately Cold CRYOBOREAL

MSST = 10.2 C
DAYS > 5 C = 198.
DAYS > 15 C = 0.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = 0.2 C
Extreme Lowest Temp. = -1.4 C
Lowest 1 year in 10 (10% Risk) = -0.70 C
Lowest 1 year in 5 (20% Risk) = -0.20 C
Probability of Temp =< 0.00 C = 31.3%
Probability of Temp =< -1.00 C = 7.9%
Years of Data = 19

SPRINGDALE GB FARM 8403702 Period : 1961-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	0.1	-0.5	-0.1	0.9	6.0	12.0	16.3	16.5	12.9	8.7	4.2	1.0
	(17)	(17)	(16)	(15)	(15)	(15)	(15)	(15)	(15)	(14)	(13)	(12)
50cm	1.3	0.4	0.7	1.0	4.4	9.5	13.4	14.7	13.0	10.2	5.7	2.6
	(17)	(17)	(16)	(15)	(15)	(15)	(15)	(15)	(15)	(14)	(13)	(12)

Soil Climatic Parameters (50 cm Depth)

MAST = 6.4 C
DEGREE-DAYS > 5 C = 1131.
DEGREE-DAYS > 15 C = 0.
CLASS = Moderately Cold CRYOBOREAL

MSST = 12.6 C
DAYS > 5 C = 184.
DAYS > 15 C = 0.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = -0.7 C
Extreme Lowest Temp. = -6.1 C
Lowest 1 year in 10 (10% Risk) = -4.07 C
Lowest 1 year in 5 (20% Risk) = -1.84 C
Probability of Temp =< 0.00 C = 50.0%
Probability of Temp =< -1.00 C = 27.1%
Probability of Temp =< -2.00 C = 17.6%
Probability of Temp =< -5.00 C = 8.1%
Years of Data = 16

NEWFOUNDLAND

STEPHENVILLE A 8403800 Period : 1955-1986

Average Soil Temperature (DEG C)
(Years)

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10cm	1.0	0.9	0.7	2.6	7.6	12.2	15.6	16.1	13.2	9.2	5.4	2.0
	(27)	(27)	(27)	(27)	(27)	(27)	(27)	(27)	(27)	(25)	(24)	(23)
50cm	2.1	1.6	1.2	2.2	5.9	10.0	13.1	14.4	13.1	10.0	6.9	3.7
	(27)	(27)	(27)	(27)	(27)	(27)	(27)	(27)	(27)	(25)	(24)	(23)

Soil Climatic Parameters (50 cm Depth)

MAST = 7.0 C
DEGREE-DAYS > 5 C = 1178.
DEGREE-DAYS > 15 C = 0.
CLASS = Moderately Cold CRYOBOREAL

MSST = 12.6 C
DAYS > 5 C = 206.
DAYS > 15 C = 0.

Lowest Monthly Average Temp. (10 cm Depth)

Average Lowest Temp. = 0.5 C
Extreme Lowest Temp. = 0.0 C
Lowest 1 year in 10 (10% Risk) = 0.10 C
Lowest 1 year in 5 (20% Risk) = 0.16 C
Probability of Temp =< 0.00 C = 3.6%
Years of Data = 27